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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/975,885	10/12/2001	Hans Martin Buschbeck	H60-099 US	9683

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EXAMINER	
SONG, MATTHEW J	
ART UNIT	**PAPER NUMBER**
1765	9

DATE MAILED: 04/08/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)
	09/975,885	BUSCHBECK ET AL
	Examiner	Art Unit
	Matthew J Song	1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 March 2003* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *49-68 and 94-96* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *49-68 and 94-96* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) 6 .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other:

DETAILED ACTION

Claim Objections

1. Claim 96 is objected to because of the following informalities: Claim 96 recites "an epitactic layer" in line 1. "Epitactic" appears to be a misspelling of "epitaxial". Appropriate correction is required.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claim 53 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 53 recites "structural members are disk-form and are **subjected positioned** horizontally and vertically stacked one above the other to the CVD process simultaneously". The language of the claim is unclear because two verbs are used in the same concept. The examiner recommends separating into two separate concepts. A possible correction would be "structural members are disk-form, positioned horizontally and vertically stacked one above the other and are subjected to the CVD process simultaneously".

4. Claim 63-64 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 63 recites, " the vacuum encompassing **it** are each pumped differently" in

line 2. It is unclear what "it" represents. The examiner recommends replacing "it" with a definite term, such as "said reaction volume" or "said heating means". Likewise for claim 64 in line 2.

5. Claim 65 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 65 recites, "these are supplied" in line 2. It is unclear what "these" represents.

Claim Rejections - 35 USC § 102

6. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

7. Claims 49, 52, 55, 58, 62, 65, and 96 are rejected under 35 U.S.C. 102(b) as being anticipated by Chu et al (US 6,013,134).

Chu et al discloses an UHV-CVD system **12** and an UHV-LPCVD system **14** coupled to a UHV transfer system **16** for moving boats **18** filled with wafers **20** between systems **12** and **14** (col 3, ln 60 to col 4, ln 10). Chu et al also discloses wafers which my have some native oxide thereon are loaded into the UHV-LPCVD system **14** to first remove the native oxide from a silicon surface by employing a hydrogen pre-bake at a temperature in the range from 800-950°C

and the wafers are transferred to the UHV-CVD chamber and a Si CMOS device structure is formed and after completion of the Si CMOS device structures the wafers **20** can be transferred up to the UHV-LPCVD, where a gate oxide can be grown (col 6, ln 1-67). Chu et al also discloses a vertical transfer system and a horizontal transfer system (col 4, ln 10-50). Chu et al also discloses transferring the substrate to a second reactor while maintaining a controlled gaseous environment and pressure between the reactors and the controlled gaseous environment includes hydrogen (col 2, ln 45-60)

Referring to claim 49, Chu et al discloses wafers **20**, this reads on applicant's structural member, a cleaning process, this reads on applicant's treatment process and forming CMOS structures on the wafers in a UHV-CVD chamber.

Referring to claim 52, Chu et al discloses a UHV transfer system for transferring wafers from UHV-CVD to LP-CVD under UHV pressures (col 1, ln 55-67).

Referring to claim 55, Chu et al discloses two or more treatment operations and the structural members are transported under vacuum along a linear transport path (col 3, ln 5-35).

Referring to claim 58, Chu et al discloses transferring the substrate to a second reactor while maintaining a controlled gaseous environment and pressure between the reactors and the controlled gaseous environment includes hydrogen (col 2, ln 45-60).

Referring to claim 96, Chu et al discloses forming epitaxial layers on the substrate in the second UHV-CVD reactor (col 3, ln 20-30), this is interpreted by the examiner to read on applicant's epitactic.

Referring to claim 62, Chu et al discloses a UHV deposition, where a reactor is evacuated to a UHV and SiH_4 is supplied to the reactor to deposit an epitaxial layer. Chu et al is silent to an

increase in pressure. The pressure will inherently increase because of the supplied gas. Furthermore, this inherent increase in pressure is discloses by Meyerson (US 5,298,452), which is incorporated by reference by Chu et al (col 7, ln 10-25).

Referring to claim 65, Chu et al discloses pre-baking the substrate surface in hydrogen and second gas of SiH_4 at a growth temperature of less than 400°C (col 2, ln 10-40).

8. Claims 49 is rejected under 35 U.S.C. 102(e) as being anticipated by Chan et al (US 6,350,321).

Chan et al discloses a UHV transfer chamber connects a plurality of UHV process chamber with an UHV transfer mechanism to enable the growth of a complete gate stack and the vacuum in each processing chamber can be matched to the pressure of the transfer chamber (col 2, ln 20-35). Chan et al also discloses the process chamber enables polysilicon deposition, this reads on applicant's treatment process, and epitaxial silicon growth, this reads on applicant's CVD process (col 5, ln 10-20). Chan et al also discloses each process chamber is heated using a circular resistor (col 5, ln 1-10).

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 50-51, 61, 63, 64, 66, and 67 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al (US 6,013,134) in view of Tsai (US 5,858,102).

Chu et al discloses all of the limitations of claim 50, as discussed previously, except the structural members are subjected horizontally to the CVD process.

In a method of chemical vapor deposition, note entire reference, Tsai teaches a CVD apparatus with a planetary susceptor rotation. Tsai also teaches a reactor includes a wall **30**, a gas inlet **40**, a heater **50** for the susceptor and substrates. Tsai also teaches the planetary susceptor can be readily adopted to other configurations of reactors, including vertical flow reactors, barrel reactors and horizontal reactors (col 2, ln 25-67). Tsai also teaches a CVD apparatus incorporating the planetary susceptor rotation significantly improves the CVD process and allows for uniformity over each substrate in a batch (col 1, ln 55-67, col 2, ln 65-67 and col 4, ln 40-67). Tsai also teaches the substrates are arranged horizontally (Figs 3-4). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Chu et al with Tsai's CVD with planetary susceptor rotation for batch coating to improve the uniformity of the coating over each substrate in the batch.

Referring to claim 51, the combination of Chu et al and Tsai teach wafers, this reads on applicant's disk form, and a horizontal treatment process on a planetary susceptor and transporting horizontally to a separate system.

Referring to claim 61 and 66, the combination of Chu et al and Tsai teach a heating means in a reactor for heating the susceptor and substrates (Fig 3), this reads on applicant's heating means disposed *in vacuo*.

Referring to claim 63, the combination of Chu et al and Tsai teach the transfer system includes pumps **40, 41, 42,** and **43** and the UHV-CVD system includes pumps **24, 25,** and **26** ('134 col 4, ln 1-25), this reads on applicant's the reaction volume and vacuum are pumped differently.

Referring to claim 64, the combination of Chu et al and Tsai teach a transfer chamber serves as a load lock for transferring wafer to an external ambient and communicated via gate valves **27** and **37** ('134 col 4, ln 1-67).

Referring to claim 67, the combination of Chu et al and Tsai teach a susceptor, this reads on applicant's support.

11. Claims 56-57 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al (US 6,013,134) in view of Fukui et al (US 5,755,938).

Chu et al discloses all of the limitations of claim 56, as discussed previously, except the structural members are subjected to a reactive, low energy plasma treatment process.

In a method of forming a film by chemical vapor deposition, note entire reference, Fukui et al teaches a substrate cleaning step, where contaminants and impurities such as H_2O, CO_2 or native oxide on the surface of a substrate is removed. Fukui et al also teaches a mixed gas atmosphere of Argon and Hydrogen is created in a deposition chamber and RF power is supplied to a first electrode to thereby perform a plasma cleaning and the ion energy applied is in the range of 10-20 eV (col 7, ln 10-30). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Chu et al with Fukui et al's plasma cleaning process

to remove contaminants and impurities such as H_2O, CO_2 or native oxide on the surface of a substrate.

Referring to claim 56, the combination of Chu et al and Fukui et al teaches an ion energy of 10-20 eV. The combination of Chu et al and Fukui et al does not teach an ion energy of 0-15 eV. Overlapping ranges are held to be obvious (MPEP 2144.05).

Referring to claim 57, the combination of Chu et al and Fukui et al teaches an atmosphere of hydrogen.

12. Claims 56-57 and 68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al (US 6,013,134) in view of Chan et al (US 5,883,016).

Chu et al discloses all of the limitations of claim 56, as discussed previously, except the structural members are subjected to a reactive, low energy plasma treatment process.

In a method of hydrogenating a thin film wafer, note entire reference, Chan et al teaches a low pressure chemical vapor deposition is used to deposit a Si layer on a substrate and hydrogenating to improve the quality of poly Si- thin film transistors (col 1, ln 20 to col 2, ln 15). Chan et al also teaches a vacuum pump and a hydrogen gas supply provide an ample supply of hydrogen to a vacuum chamber at an appropriate pressure for processing. Chan et al also teaches after a wafer is mounted on a wafer holder the pressure within the vacuum chamber is reduced to 10^{-6} Torr and hydrogen gas is introduced so as to raise the pressure within the vacuum chamber to approximately 0.6 mTorr. Chan et al also teaches the hydrogen gas is ionized into a plasma with an electron temperature of approximately 5 eV, this reads on applicant's ion energy (col 6, ln 35-60). Chan et al also teaches a temperature sensor **28** is connected to the wafer holder **32**

and the temperature of the wafer is monitored (col 6, ln 15-35). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Chu et al with Chan et al's hydrogenation to form a thin film transistor (TFT) useful in liquid crystal displays (col 1, ln 20-30).

Referring to claim 56, the combination of Chu et al and Chan et al teaches an ion energy of 5 eV. The combination of Chu et al and Chan et al does not teach an ion energy of 0-15 eV. Overlapping ranges are held to be obvious (MPEP 2144.05).

Referring to claim 57, the combination of Chu et al and Chan et al teaches an atmosphere of hydrogen.

Referring to claim 68, the combination of Chu et al and Chan et al teach a wafer holder **32,** this reads on applicant's support, and a temperature sensor **28** connected to the wafer holder.

13. Claims 53-54 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al (US 6,013,134) in view of Fuse et al (US 5,217,501).

Chu et al discloses all of the limitations of claim 53, as discussed previously, except the structural members are subjected positioned horizontally and vertically stacked one above the other.

In a method of heat treating wafers in a vertical heat treatment apparatus, note entire reference, Fuse et al teaches a wafer boat **18** for treating a number of wafers as a batch and the wafers are mounted on the boat, with each wafer kept horizontal and arranged at predetermined intervals in the vertical direction applied to a vertical CVD apparatus (col 3, ln 25-67). Fuse et al

also teaches a first load lock chamber **40** and a vertical movement mechanism **26.** Fuse et al also teaches a vacuum is built in the first load lock chamber. Fuse et al also teaches wafer stockers **71** and **72** capable of stocking a number of wafers and wafers are taken out one by one from the stocker and transferred onto the boat and after the treatment process are transferred back (col 4, ln 1-45). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Chu et al with Fuse et al's vertical CVD apparatus because an oxide formation is reduced in a vertical furnace compared to a horizontal furnace (col 1, ln 15 to col 2, ln 25) and a vertical furnace has increased capacity over a horizontal furnace.

Referring to claim 54, the combination of Chu et al and Fuse et al teach wafer stockers **71** for transferring wafers one by one chamber.

14. Claims 59-60 and 66-68 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al (US 6,013,134) in view of Olsen et al (US 6,021,152).

Chu et al discloses all of the limitations of claim 59, as discussed previously, except the average temperature and the temperature distribution in a reaction volume of the CVD process are measured and controlled.

In a method of controlling temperature uniformity in a CVD process, note entire reference, Olsen et al teaches a reflector plate in a reaction chamber to achieve a uniform temperature distribution across a substrate (Abstract and col 1, ln 15-65) and the power of various lamps **56, 66** can be controlled independently in response to temperature sensors arranged in proximity to the substrate **20** (col 4, ln 10-60). Olsen et al also teaches the advantages are applicable to batch wafer processing furnaces (col 3, ln 40-55). It would have

been obvious to a person of ordinary skill in the art at the time of the invention to modify Chu et al with Olsen et al's CVD reactor with sensors and reflector plates to achieve a uniform temperature distribution within the chamber and across the wafer to improve the uniformity of the deposited films (col 1, ln 25-55).

Referring to claim 66, the combination of Chu et al and Olsen et al teach the lamps **56** are mounted within the chamber ('152 col 4, ln 5-20), which operates an ultra high vacuum.

15. Claim 94 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al (US 6,013,134) in view of Suntola (US 4,058,430).

Chu et al discloses all of the limitations of claim 94, as discussed previously, except a CVD process, where an atomic layer deposition is carried out.

In a method of forming compound thin films, note entire reference, Suntola et al teaches an atomic layer epitaxy, this reads on applicant's ALD, and highly oriented compound thin films are produced with almost perfect stoichiometry by alternately subjecting the substrate to the vapor of each of the elements of which the compound is formed in a vacuum chamber **10** (col 1, ln 60-67, col 2, ln 45-67 and col 5, ln 20-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Chu et al with Suntola et al's ALD to form thin films with almost perfect stoichiometry.

16. Claim 95 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chu et al (US 6,013,134) in view of Shiozawa et al (US 5,888,876).

Chu et al discloses all of the limitations of claim 95, as discussed previously, except a CVD process, where a deep trenches layer deposition is carried out.

In a method of deep trench filling using silicon film deposition, note entire reference, Shiozawa et al teaches a deep trench is formed in a surface of a silicon substrate and a thin polycrystalline silicon layer is deposition in the trench and on the surface of the substrate using a CVD process (col 3, ln 1-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Chu et al with Shiozawa et al's deep trenches layer deposition to form a semiconductor memory device.

Conclusion

17. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Kakizaki et al (US 5,088,922) teaches the type of a heat treatment furnace to be used is shift from a horizontal type to a vertical type, resulting in a great increase in the furnace capacity (col 1, ln 10-25).

Meyerson (US 5,298,452) teaches a pumping apparatus to create a total press less than 10^{-8} Torr and supplying silane to increase the total pressure of the system to 10^{-2} to 10^{-4} Torr (col 9, ln 1-67).

Edwards (US 5,259,881) teaches temperature sensors measure temperature for control of the heating of the lamps (Abstract).

Kishimoto et al (US 6,033,990) teaches hydrogen plasma with an energy of 10-20 eV (col 2-3).

18. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J Song whose telephone number is 703-305-4953. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Benjamin L Utech can be reached on 703-308-3868. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9310 for regular communications and 703-872-9311 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0661.

Matthew J Song
Examiner
Art Unit 1765

MJS
April 4, 2003

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